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# मानक

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IS 3920 (1985): Methods for sampling of cotton yarn for the determination of physical characteristics [TXD 1: Physical Methods of Tests]



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**IS : 3920 - 1985**  
**( Reaffirmed 1999 )**

*Indian Standard*

**METHODS FOR  
SAMPLING OF COTTON YARN FOR  
DETERMINATION OF PHYSICAL  
CHARACTERISTICS**

***( First Revision )***

**( First Reprint JANUARY 2000 )**

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**Gr 3**

*July 1985*

**AMENDMENT NO. 1   APRIL   2000**  
**TO**  
**IS 3920 : 1985   METHODS FOR SAMPLING OF**  
**COTTON YARN FOR DETERMINATION OF PHYSICAL**  
**CHARACTERISTICS**

*( First Revision )*

*( Page 6, clause 3.1.1, line 2 ) — Substitute 'lea breaking load and twist' for 'and lea breaking load' .*

**( TX 1 )**

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**Reprography Unit, BIS, New Delhi, India**

***Indian Standard***  
**METHODS FOR**  
**SAMPLING OF COTTON YARN FOR**  
**DETERMINATION OF PHYSICAL**  
**CHARACTERISTICS**  
**( *First Revision* )**

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Sampling Methods Sectional Committee, TDC 33

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**IS : 3920 - 1985**

*( Continued from page 1 )*

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***Indian Standard***  
**METHODS FOR**  
**SAMPLING OF COTTON YARN FOR**  
**DETERMINATION OF PHYSICAL**  
**CHARACTERISTICS**  
**( *First Revision* )**

**0. FOREWORD**

**0.1** This Indian Standard ( First Revision ) was adopted by the Indian Standards Institution on 17 January 1985, after the draft finalized by the Sampling Methods Sectional Committee had been approved by the Textile Division Council.

**0.2** This standard was first published in 1966. The number of tests and the criteria for conformity for the various characteristics was recommended on the consideration that, in the relevant material specification, these requirements are specified in terms of nominal value and tolerances on individual test results. However, the standards on various types of yarn published/revised after 1966 give the requirement, in terms of nominal value for lot average together with tolerances ( or minimum value for lot average ) and a maximum limit for coefficient of variation. Thus it was necessary to revise the standard to change the criteria for conformity and also provide for suitable sample size for determination of the coefficient of variation.

**0.3** An extensive amount of data has been collected from a large number of textile mills to assess the inherent variability of the various characteristics and recommend the number of tests to determine the characteristics with specified degree of accuracy.

**0.4** In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960\*.

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\*Rules for rounding off numerical values ( *revised* ).



## **1. SCOPE**

**1.1** This standard prescribes the methods of sampling for cotton yarn for determination of physical characteristics, namely, count, lea breaking load, twist, evenness ( uster percent ) and appearance grade. It specifies the number of tests that should be made for each characteristic. It also lays down the criteria for ascertaining the conformity of the yarn to the specified requirements of the characteristics.

## **2. TERMINOLOGY**

**2.0** For the purpose of this standard, the following definitions shall apply.

**2.1 Bale ( or Case )** — A compressed package of defined quantity of yarn in a form convenient for transit.

**2.2 Coefficient of Variation ( CV )** — The ratio of the standard deviation to the absolute value of the mean expressed as percentage.

**2.3 Consignment** — The quantity of yarn delivered to one buyer against one despatch note.

**2.4 Cotton Yarn** — A continuous twisted strand of cotton fibres.

**2.5 Count** — An expression of linear density.

**2.5.1 Tex** — A number indicating the weight in grams of one kilometre of yarn.

NOTE — The relationship between tex and cotton count is:

$$\text{tex} = \frac{590.5}{\text{Cotton count}}$$

**2.6 Evenness** — The uniformity of any textile material in terms of thickness or diameter or weight per unit length.

**2.7 Lea** — A continuous length of yarn measuring 109.73 m ( 120 yd ) in the form of a coil wound, having 80 wraps, on a reel of 1.37 m ( 1.5 yd ).

**2.8 Lea Breaking Load** — The breaking load of a lea determined by pendulum type testing machine, the rate of traverse being  $300 \pm 15$  mm/min.

**2.9 Lot** — All packages of yarn of one grade, one definite type and quality belonging to a consignment.

**2.10 Limit of Error of Mean** — The maximum difference between the sample mean and its true value ( that would be obtained if all the units in the lot were tested ) at a given probability level.

**2.11 Limit of Error of Coefficient of Variation ( CV )** — The maximum difference between the sample coefficient of variation and its true value ( that would be obtained if all the units in the lot were tested ) at a given probability level.

**2.12 Mean** — The sum of the observations divided by the number of observations.

**2.13 Package ( Yarn )** — A length or lengths of yarn in a form suitable for handling, storing or shipping. Packages may be unsupported as skeins or cakes, or prepared with various winding patterns on bobbins, cops, cones, pirns, spools, tubes or beams.

**2.14 Probability Level** — A measure of probability associated with the sample size and limit of error of estimate. It expresses the probability that the difference between the estimate based on the sample of a particular size and its true value does not exceed the specified limit of error.

**2.15 Sample** — Collection of packages of yarn selected for inspection from a lot.

**2.16 Sample Standard Deviation** — The positive square root of the quotient obtained by dividing the sum of squares of the deviations ( differences ) of the individual test results from their mean value, by one less the number of test results.

**2.17 Test Specimen** — A specific portion of the yarn selected from a package for performing a single test.

**2.18 Twist** — The number of turns per unit length of yarn expressed in turns per metre ( tpm ).

### 3. NUMBER OF TESTS

**3.1** The minimum number of tests to be made for determination of average values of various characteristics of yarn in a lot shall depend upon the accuracy with which the averages are to be determined. Table 1 gives the number of tests necessary for yarn manufactured in the country for determination of average values of count, lea breaking load, evenness and twist for varying limits of error.

CHARACTERISTIC	TABLE 1 NUMBER OF TESTS						
	LIMIT OF ERROR OF MEAN ( PERCENT )						
	2	3	4	5	6	8	10
Count	25	15	10	5	—	—	—
Lea breaking load	100	45	25	20	15	10	5
Evenness ( Uster, percent )	80	35	20	15	10	5	—
Twist	65	30	28	10	7	5	—

NOTE — Wherever the number of tests have become too small they have not been specified.

**3.1.1** Unless otherwise agreed to between the buyer and the seller, 25 tests for count, and lea breaking load and 10 tests for evenness and twist shall be made for evaluation of average values.

**3.1.2** For inspection for appearance grade five packages shall be selected at random from a lot and one test specimen shall be prepared from each package. As far as possible equal number of packages shall be selected from each bale/case. When the number of bales/cases is 8 or 13 five bales/cases shall be selected at random and from each bale/case one package shall be selected.

**3.2** The minimum number of tests to be made for determination of coefficient of variation of various characteristics of yarn in the lot shall depend upon the accuracy with which the coefficient of variation are to be determined. Table 2 gives the number of tests necessary for yarn manufactured in the country for determination of coefficient of variation of count and lea breaking load for varying limits of error.

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**TABLE 2 NUMBER OF TESTS FOR DETERMINATION OF CV**

<b>LIMIT OF ERROR OF CV ( PERCENT )</b>	<b>NUMBER OF TESTS</b>
(1)	(2)
4	1 200
5	800
8	300
10	200
15	90
20	50
30	25

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**3.2.1** It can be seen from Table 2 that 200 tests are required for determination of coefficient of variation with an accuracy of 10 percent. However, for a manufacturing concern, the coefficient of variation can be determined from routine tests conducted over a period of time to any degree of accuracy required.

#### **4. SAMPLING**

**4.1** Test specimens shall be sampled from each lot for determination of physical characteristics of yarn. In order that the test specimens selected be representative of the lot, they shall be distributed over the bales or cases in the lot, packages in a bale or case and skeins of yarn within packages. Unless otherwise agreed to between the buyer and the seller, the number of bales or cases to be taken from a lot for the purpose shall depend upon the size of the lot and be in accordance with Table 3.

**TABLE 3 NUMBER OF BALES OR CASES TO BE  
CHOSEN FROM A LOT**

( Clause 4.1 )

LOT SIZE ( BALES OR CASES )	NO. OF BALES OR CASES TO BE CHOSEN
2 to 8	2
9 to 15	3
16 to 25	5
26 to 50	8
51 and above	13

**4.2** The bales or cases shall be selected at random from the lot, and in order to ensure the randomness of selection of the bales or cases, the procedure given in IS : 4905-1968\* shall be adopted.

**4.3** From each selected bale or case approximately equal number of packages shall be chosen at random for drawing specimens for test.

**4.3.1** The minimum number of packages to be selected from any bale or case shall be determined by dividing the number of tests to be conducted ( see Table 1 ) by the number of bales or cases selected ( see Table 3 ). If it comes out to be a fractional number, its integral part ( say,  $r$  ) shall be taken and  $r$  or  $( r + 1 )$  packages shall be chosen from each selected bale or case so as to get the requisite number of packages for tests. In case the minimum number of tests happens to be less than the number of bales or cases selected, one or more packages shall be taken from each bale or case so as to get the number of packages selected to be an integral multiple of 5 just greater than the number of bales or cases chosen.

**4.4** From each of the packages selected, one test specimen shall be taken for determining the various characteristics. While drawing the test specimens care shall be taken to exclude at least 20 m of yarn from the ends. The test specimens thus collected from different packages shall constitute the test sample.

**4.5** The specimens thus selected shall be subjected to relevant tests for determining the different characteristics.

## **5. CRITERIA FOR CONFORMITY**

**5.1** The lot shall be declared conforming to the requirements regarding average values for various characteristics, if the calculated average value meets the relevant requirement of the standard.

\*Methods for random sampling.

**5.2** The lots shall be declared conforming to the requirements of coefficient of variation if the calculated value of CV is less than the maximum limit specified.

## **6. ILLUSTRATIVE EXAMPLE**

**6.1** A consignment of 30 cases of cotton yarn of 40s count according to IS : 171-1973\* was delivered to a buyer who desires to ascertain the conformity of the lot to the requirement to count IS : 171-1973\* specifies that the tolerance of  $\pm 3$  percent on average count and the maximum CV ( percent ) of 5.

According to Table 3, the number of cases to be selected for drawing packages are 8 and the number of tests to be carried out are 25 according to 3.1.1. Thus, three packages each of yarn are drawn, from seven of the cases selected and four packages from the eighth case. One test specimen is prepared from each package thus selected.

The test results obtained on the test specimen thus selected are given below:

39.8	38.8	39.2	39.2	39.8
41.2	39.5	38.2	38.5	41.2
40.5	40.0	40.5	40.5	39.5
39.5	39.5	39.5	38.5	40.0
42.2	40.2	40.8	39.5	38.5

The mean, the standard deviation and the coefficient of variation are calculated as given below:

$$\begin{aligned}\text{Mean } (\bar{x}) &= \frac{39.8 + 41.2 + \dots + 40.0 + 38.5}{25} \\ &= \frac{994.6}{25} \\ &= 39.78\end{aligned}$$

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\*Specification for grey cotton yarn ( second revision ).

$$\begin{aligned}
 \text{Sample standard deviation (s)} &= \sqrt{\frac{\sum x_i^2 - \frac{(\sum x_i)^2}{n}}{n - 1}} \\
 &= \sqrt{\frac{39\,591.44 - \frac{(994.6)^2}{25}}{24}} \\
 &= \sqrt{0.9281} \\
 &= 0.96
 \end{aligned}$$

$$\begin{aligned}
 \text{CV ( percent )} &= \frac{0.96}{39.78} \times 100 \\
 &= 2.4
 \end{aligned}$$

It can be seen that the requirement of IS : 171-1973\* are met by lot.

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\*Specification for grey cotton yarn ( second revision ).

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